ROLE BASED ACCESS CONTROL (RBAC)

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ACTIVE PARTICIPANTS

- SDCT: Rick Kuhn, Bill Majurski, Tony Cincotta, Alan Goldfine
- CSD: Dave Ferraiolo, Doctor Ramaswamy Chandramouli
- GMU: Professor Ravi Sandhu, Jean Park
- UM: Doctor Virgil Gligor
- SETA: Ed Coyne, Ravi Sundaram (CRADA)
- VDG: Serban Gavrilla (contractor)

ROLE BASED ACCESS CONTROL (RBAC)

RBAC is an access control mechanism which:

- Describes complex access control policies.
- Reduces errors in administration.
- Reduces cost of administration.

NIST RBAC Activities

- NIST RBAC Model (Ferraiolo, Cugini, Kuhn)
- NIST RBAC Model Implementation for the WWW (RBAC/Web)
- Administrative tools: RBAC/Web Admin Tool & RGP-Admin
- Formal description of NIST RBAC Model in PVS (software specification in mathematical language)
- Test assertions and test software
- Cost model and role engineering tools
- Two patent applications and a provisional patent application

INDUSTRY RECOGNITION

- **IBM**'s patent application for IBM RBAC model cited NIST work as "closest prior art" (now implemented by **Tivoli**)
- **Sybase** and **Secure Computing** implemented NIST RBAC Model
- **Siemens Nixdorf** implemented parts of NIST RBAC Model in Trusted Web and references our work on their Web site
- NIST RBAC Model to be included in **Educom** IMS Specification
- Received **1998 Excellence in Technology Transfer Award** from **Federal Laboratory Consortium**

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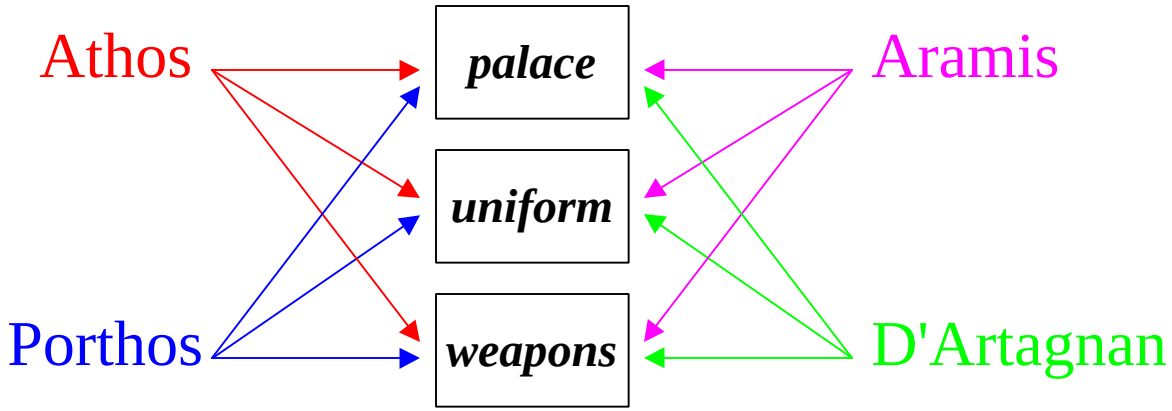
"I would like to take this opportunity to underscore the importance and relevance of research conducted by your laboratory into Role-Based Access Control (RBAC). In the area of security one of the features most requested by Sybase customers has been RBAC. They view this feature as indispensable for the effective management of large and dynamic user populations."

Thomas J. Parenty
Director, Data and Communications Security
Sybase, Inc.
Emeryville, Ca.

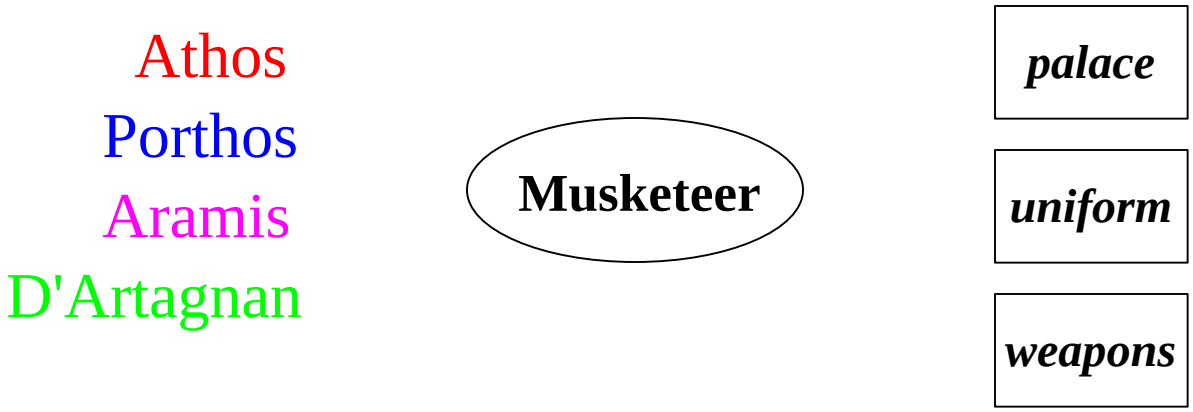
RBAC MECHANISM

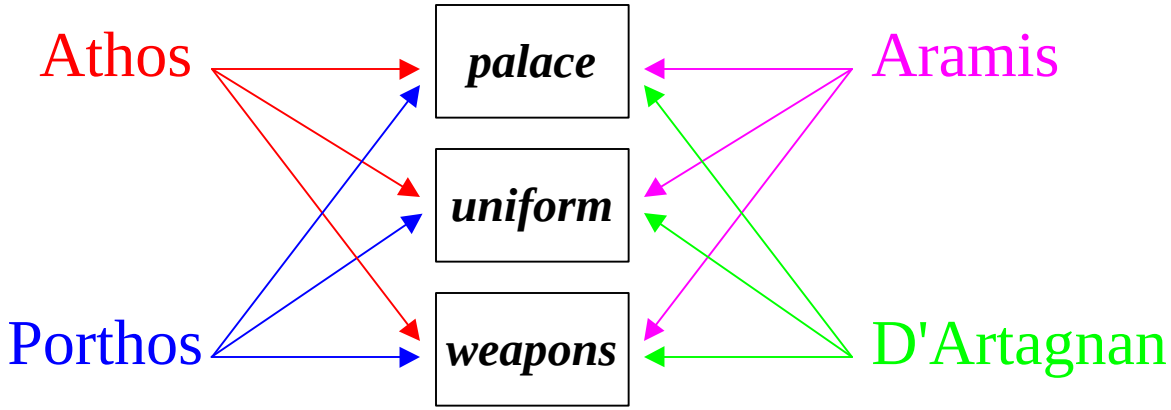
- Users are associated with roles.
- Roles are associated with permissions.
- A user has a permission only if the user has an authorized role which is associated with that permission.

Example: The Three Musketeers (User/Permission Association)



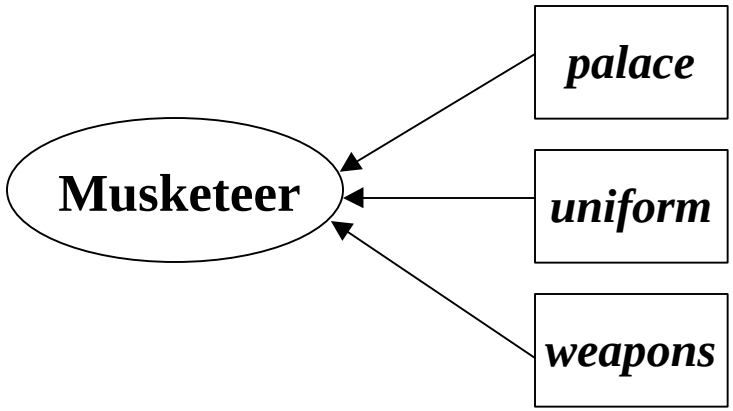
Example: The Three Musketeers (RBAC)

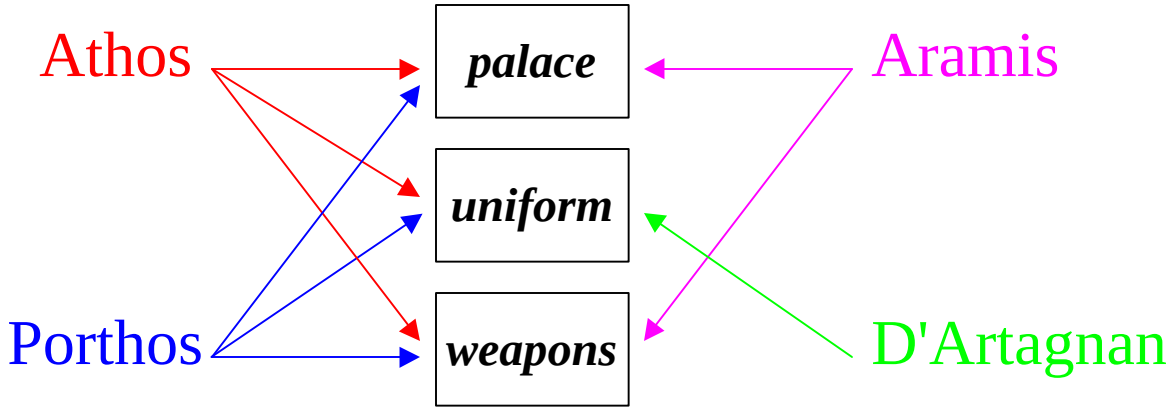




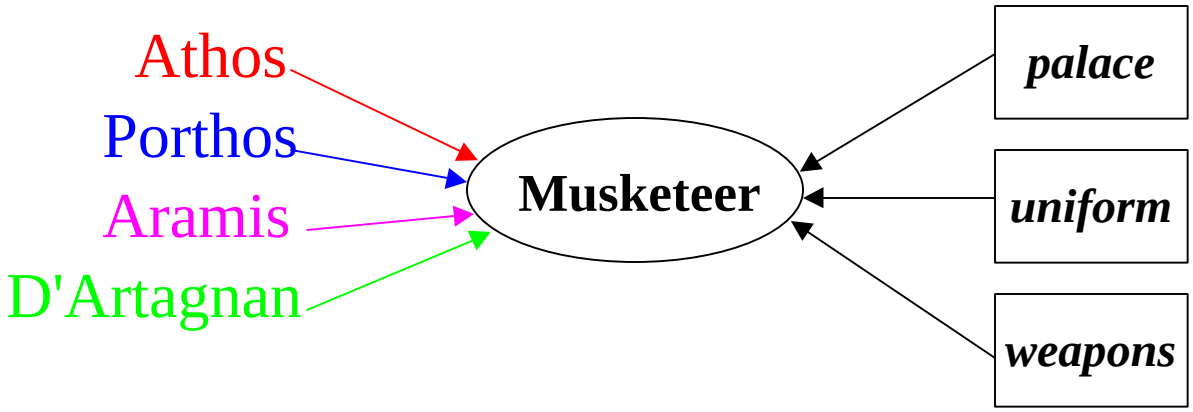
Example: The Three Musketeers (RBAC)

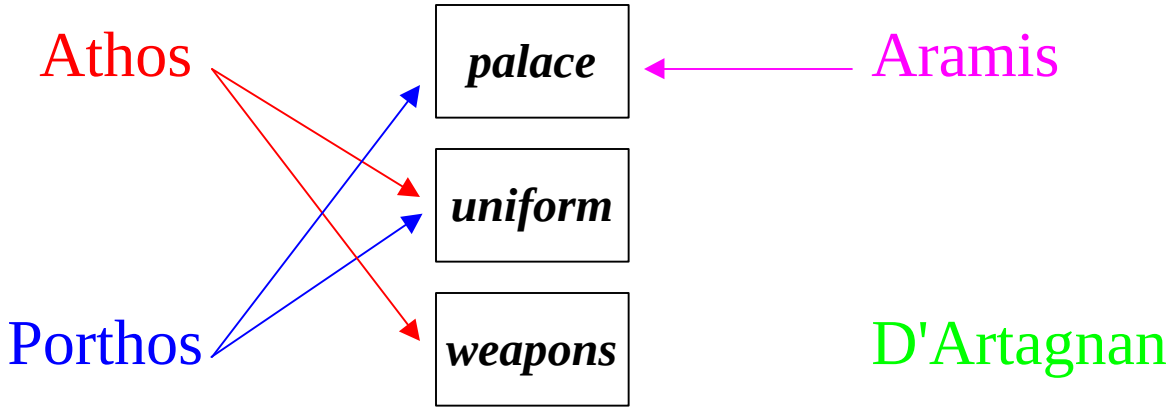
Athos
Porthos
Aramis
D'Artagnan





Example: The Three Musketeers (RBAC)





Quantifying RBAC Advantage

- For each job position, let:

$U =$ Number of individuals in job position

$P =$ Number of permissions required for job position

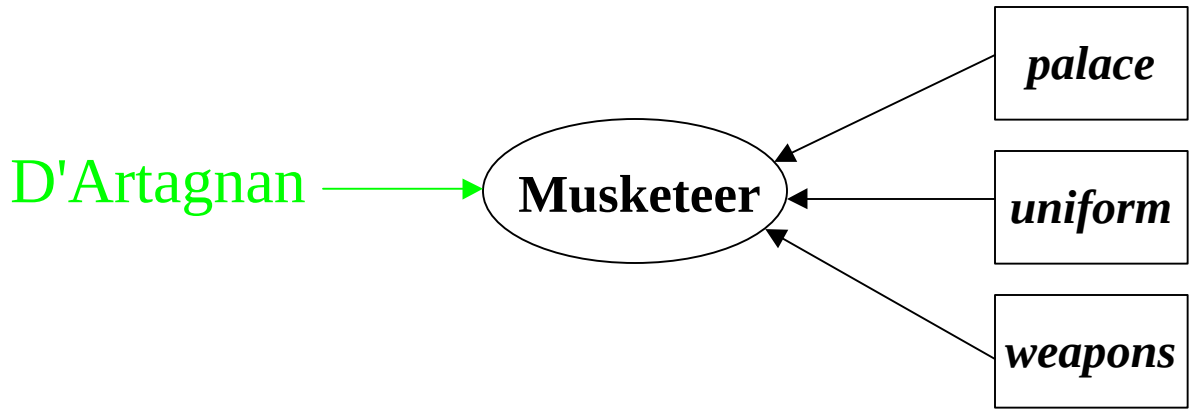
$$(U + P) < (U \cdot P) \Rightarrow \text{RBAC advantage}$$

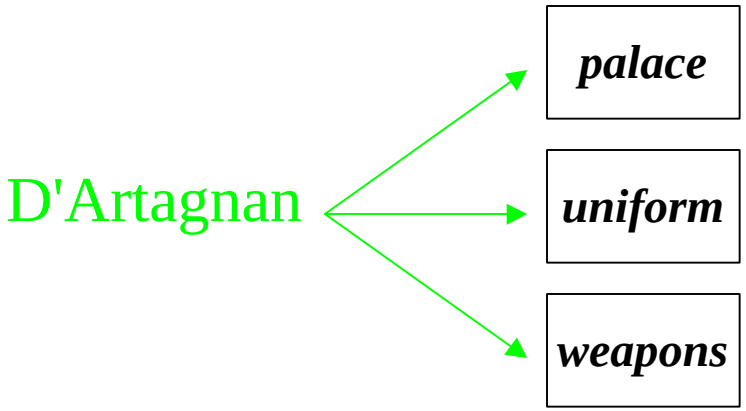
$$U, P > 2 \Rightarrow (U + P) < (U \cdot P)$$

- For all job positions,

$$\sum_{i}^{n_{jp}} (U_i + P_i) < \sum_{i}^{n_{jp}} (U_i \cdot P_i) \Rightarrow \text{RBAC advantage}$$

Example: (D'Artagnon becomes a Musketeer)

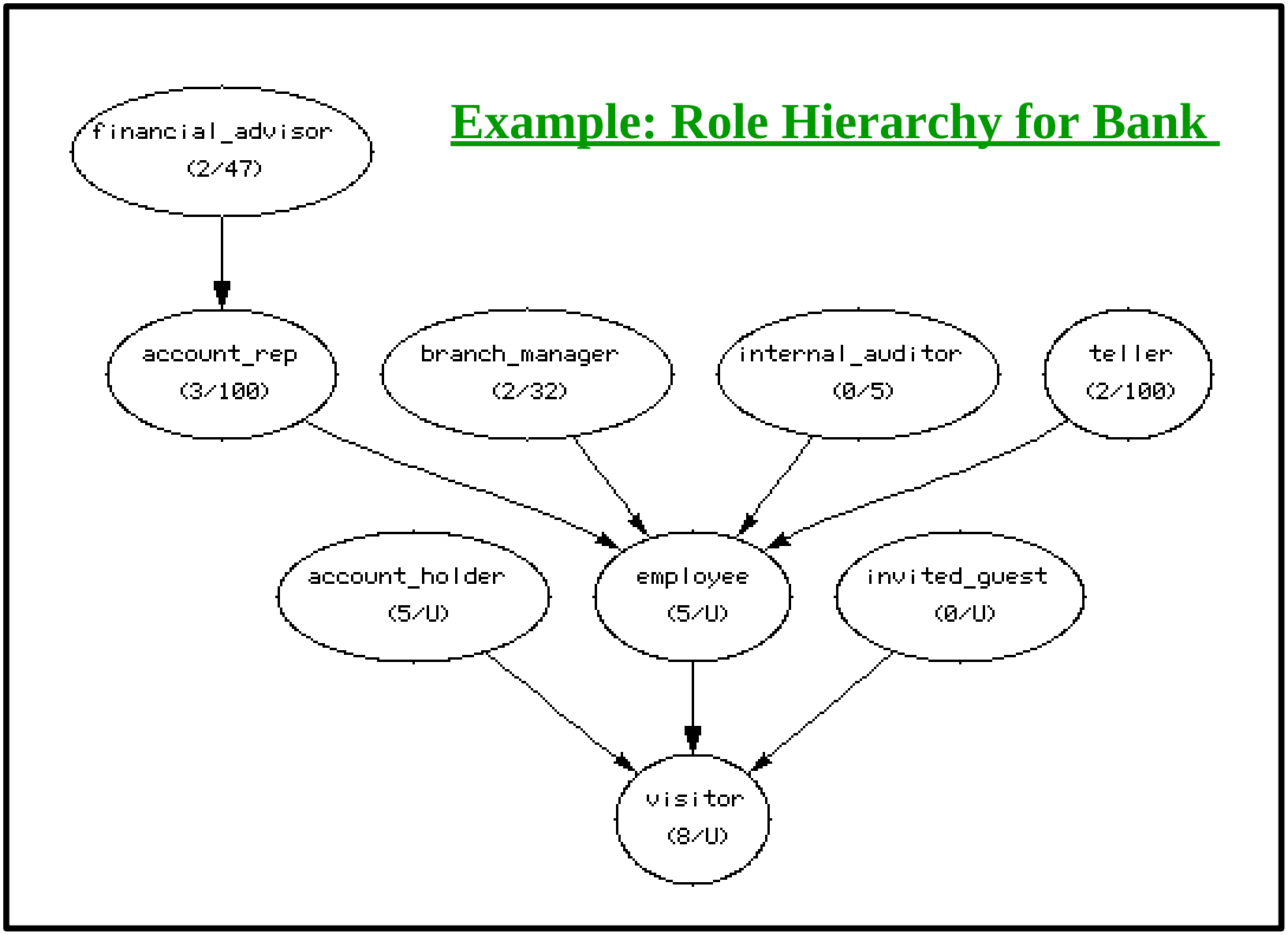




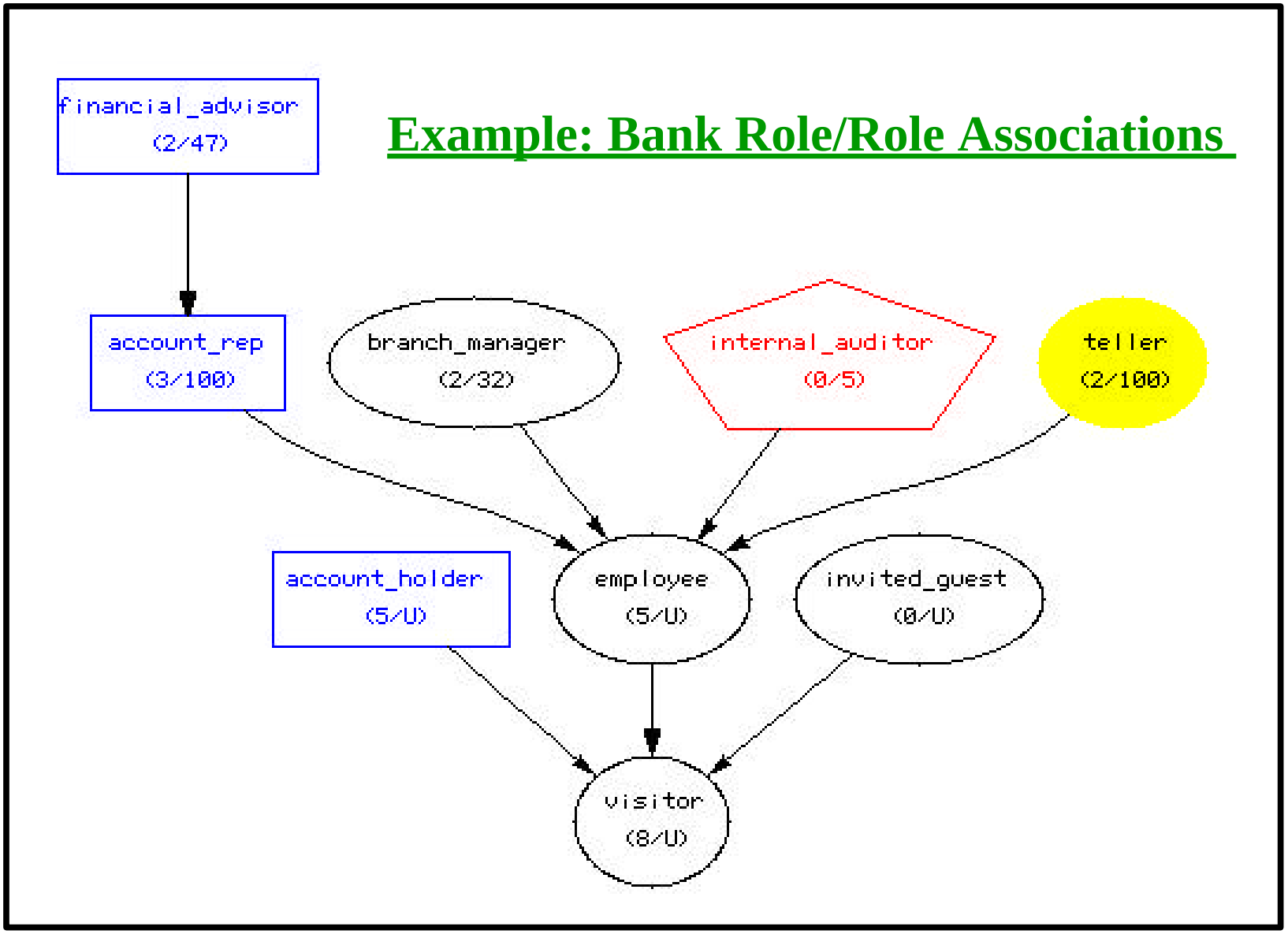
NIST RBAC Model

- Role Hierarchies, e.g, teller inherits employee
- Conflict of Interest Constraints:
  - Static Separation of Duty: user cannot be authorized for both roles, e.g., teller and auditor
  - Dynamic Separation of Duty: user cannot act simultaneously in both roles, e.g., teller and account holder
- Role Cardinality: maximum number of users authorized for role, e.g., branch manager

Example: Role Hierarchy for Bank



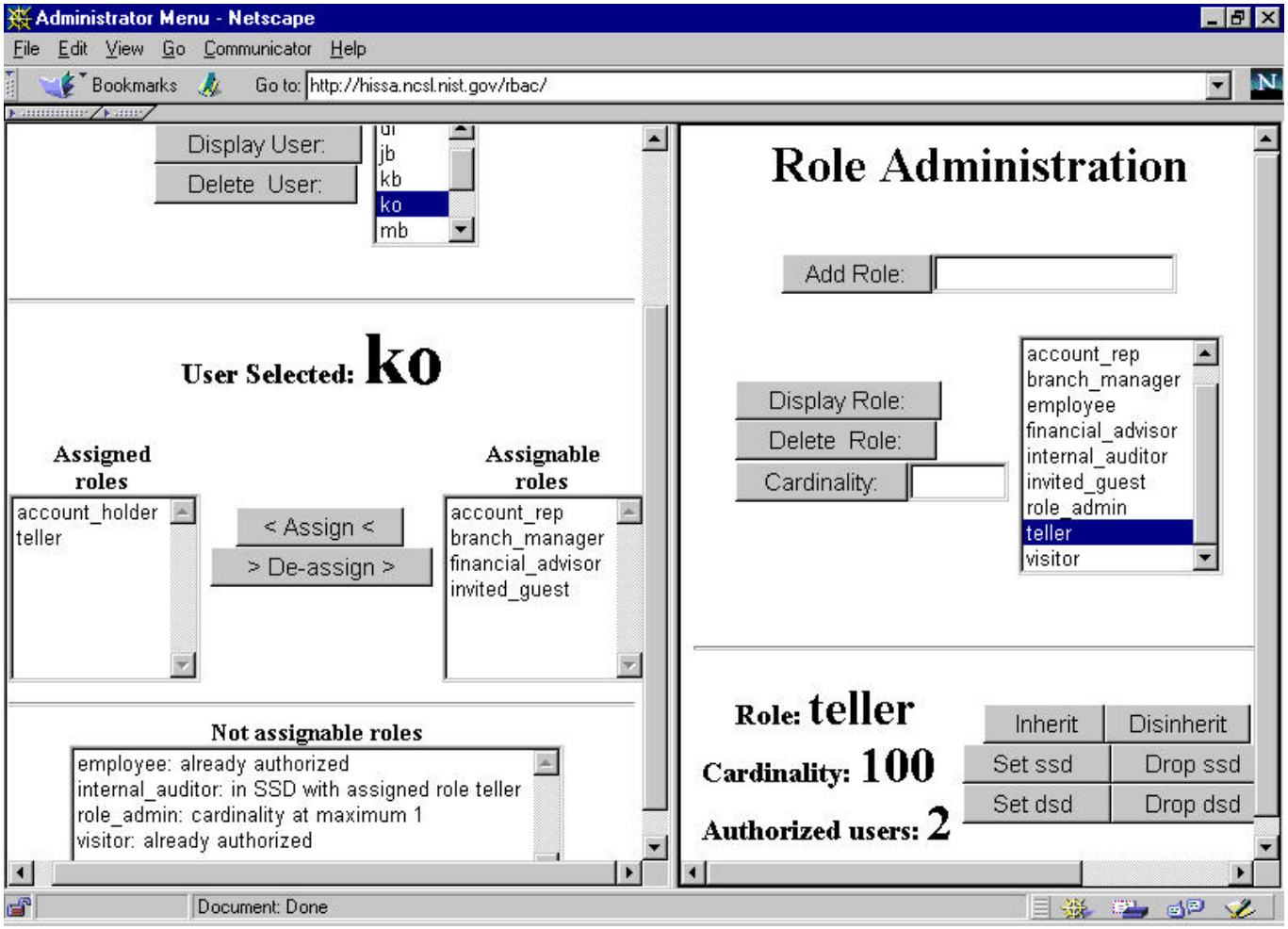
Example: Bank Role/Role Associations



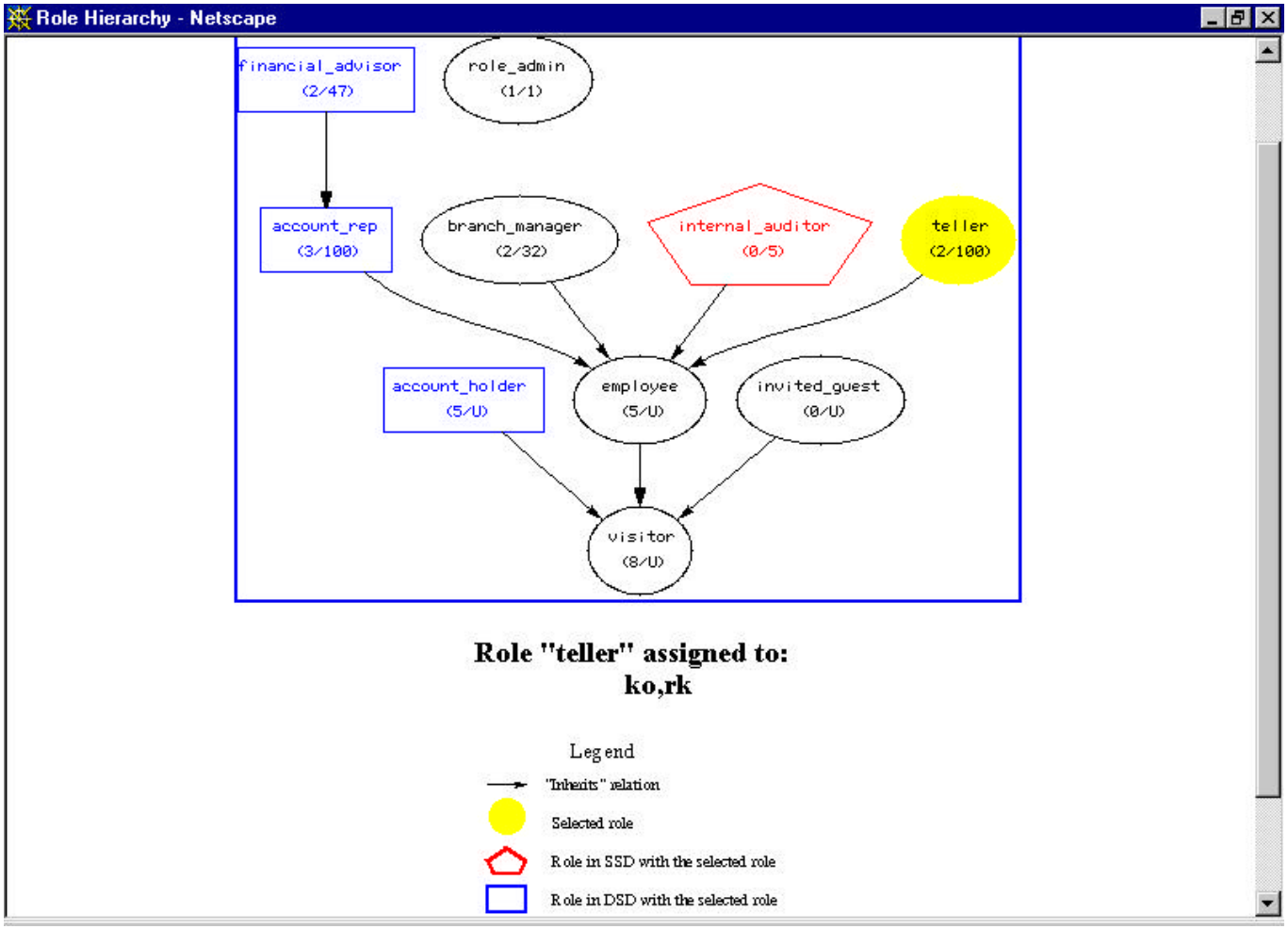
RBAC Administrative Tools

- RBAC Admin Tool: user/role and role/role associations (RBAC/Web, NT, RDBMS)
- RGP-Admin: role/permission associations (NT)
- AccessMgr: Manipulation of all features of Windows NT ACLs
- Tool building with visual components
- Role Engineering and Diagnostic Tool

RBAC/Web Admin Tool: Main Display



RBAC/Web Admin Tool: Graphical Display



RBAC/Web login screen for ko

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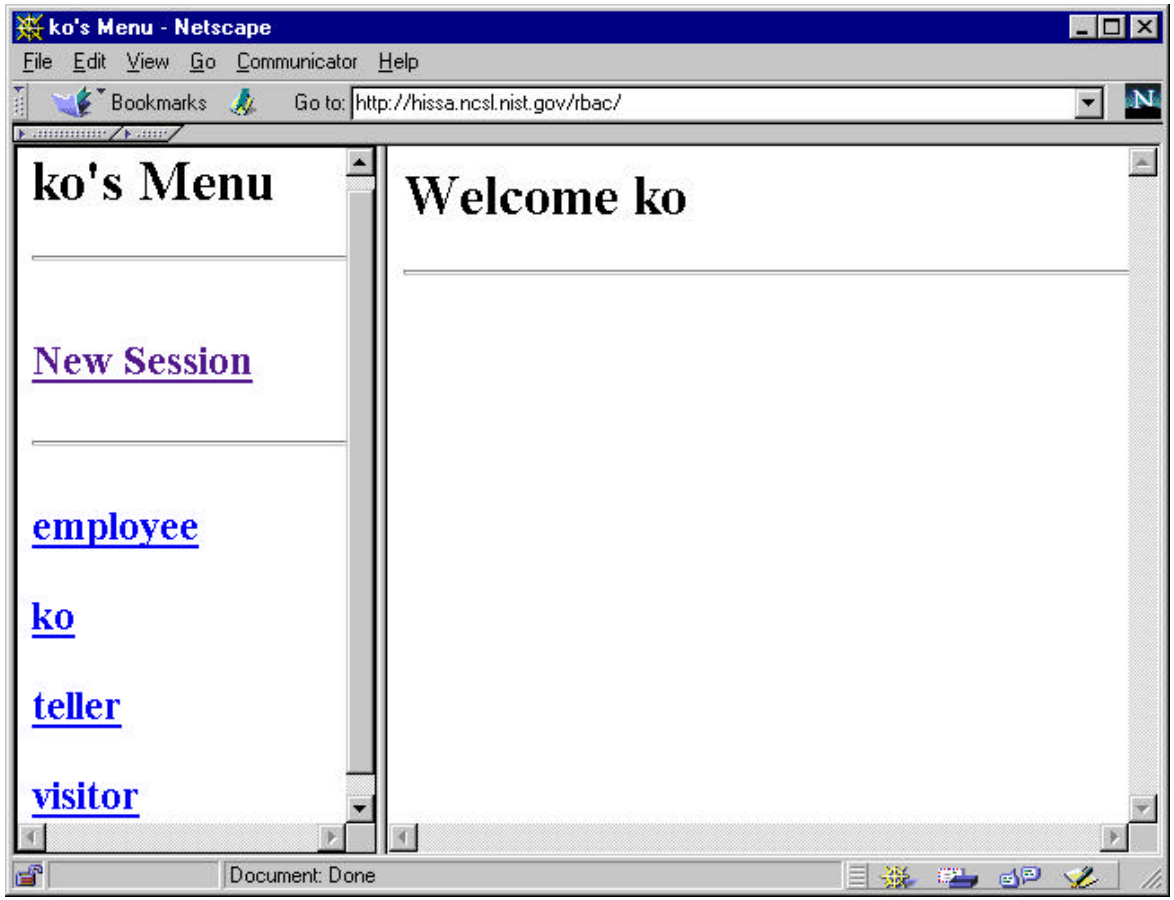
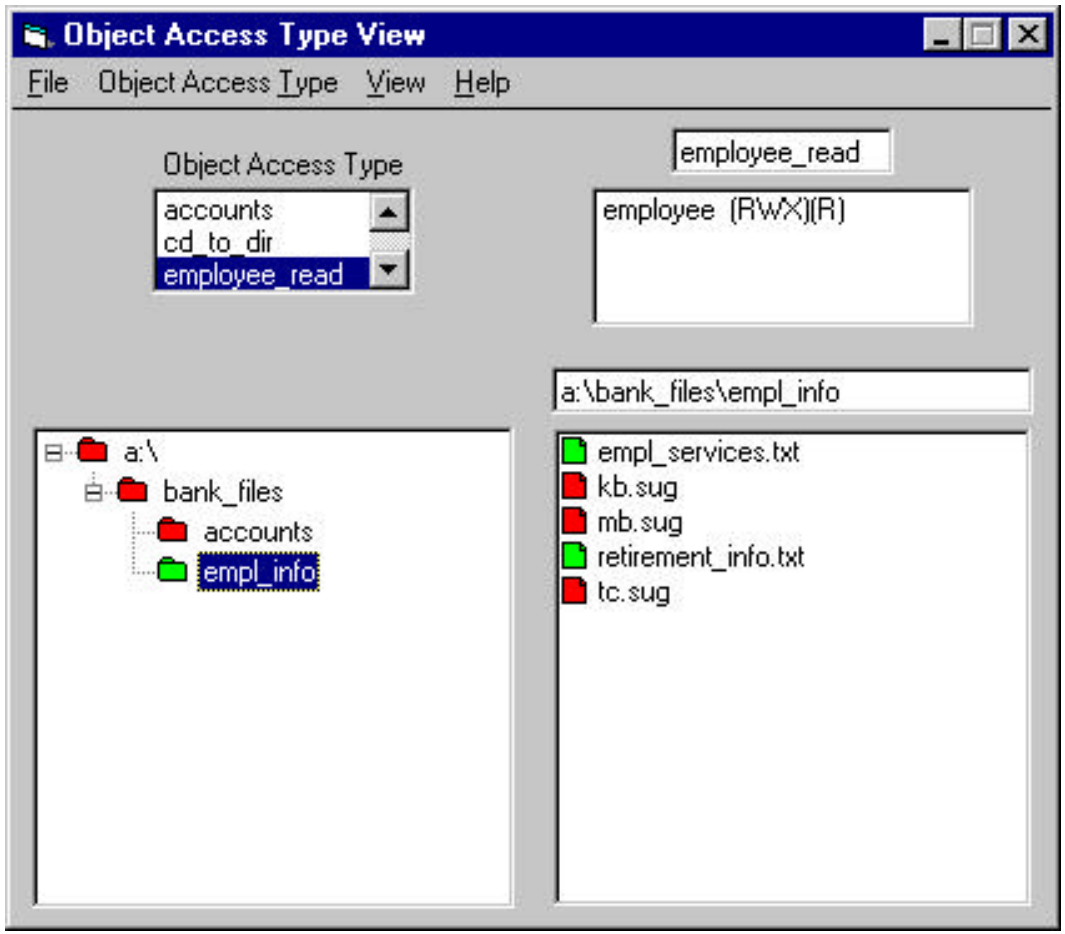
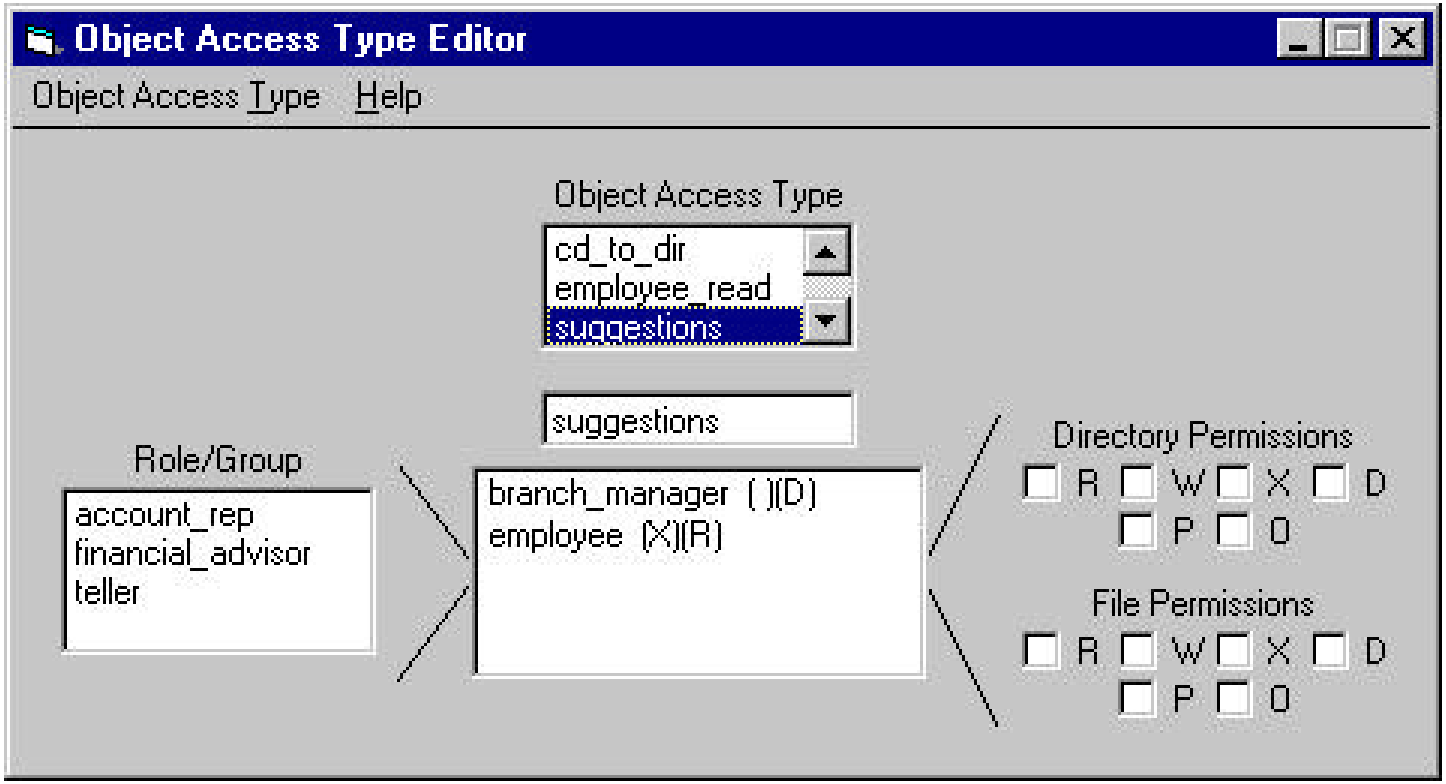


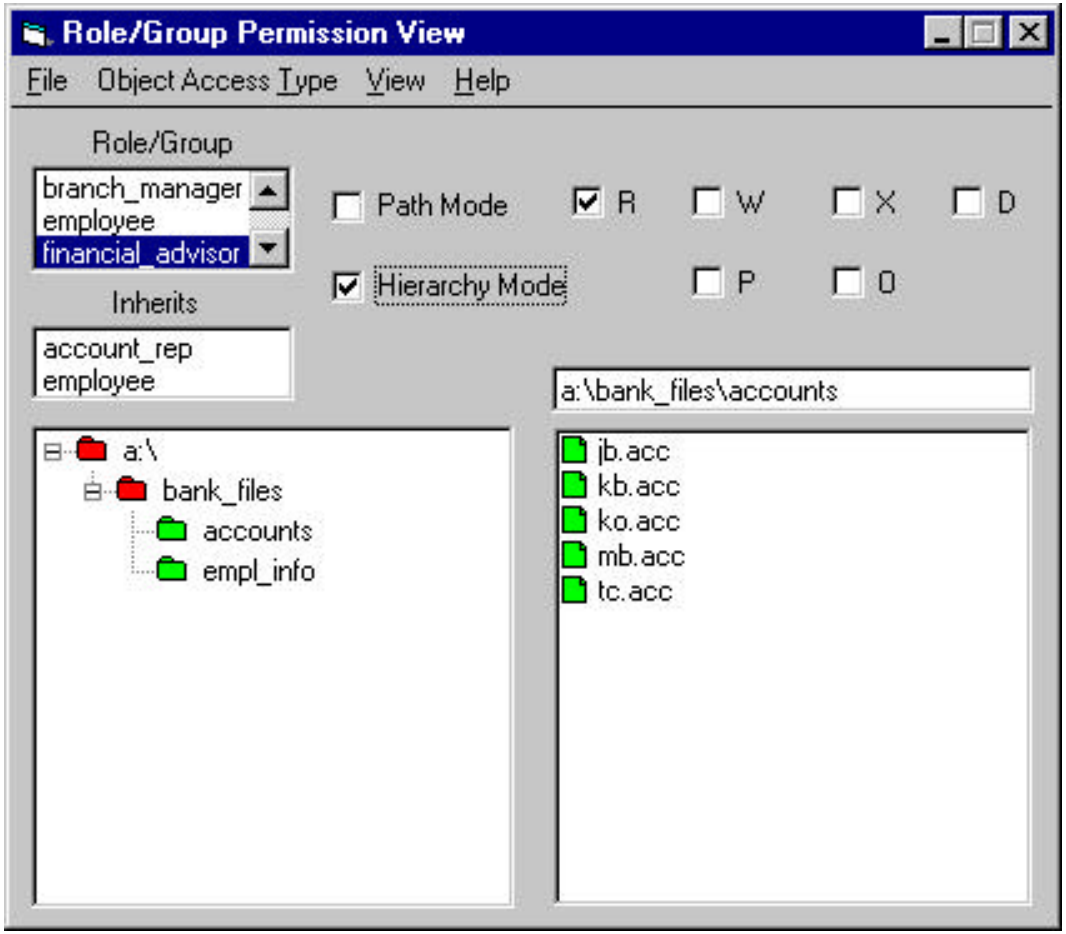
RGP-Admin: Object Access Type Window



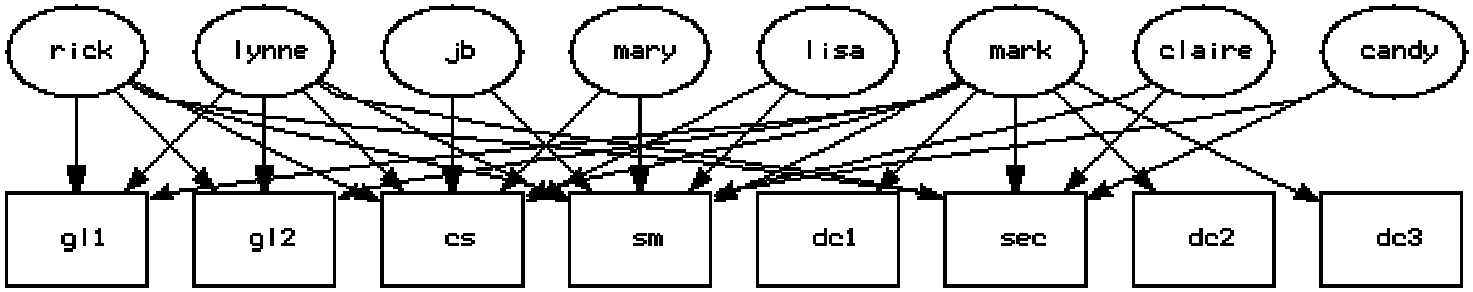
RGP-Admin: Object Access Type Edit Window



RGP-Admin: Role/Group Permission Window

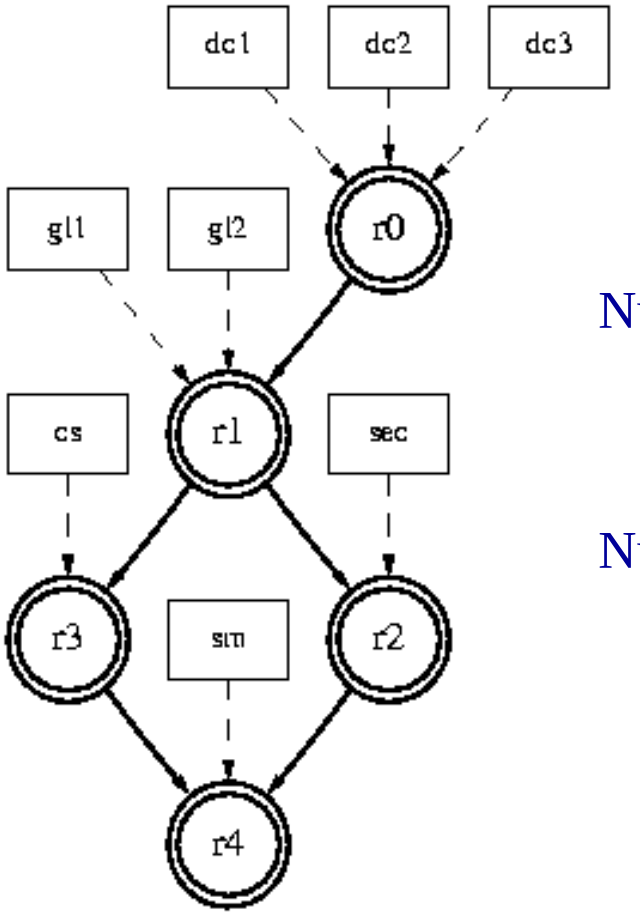


Role Engineering and Diagnostic Tool: input



Number of user/permission associations: 28

Role Engineering Tool: role/permission output

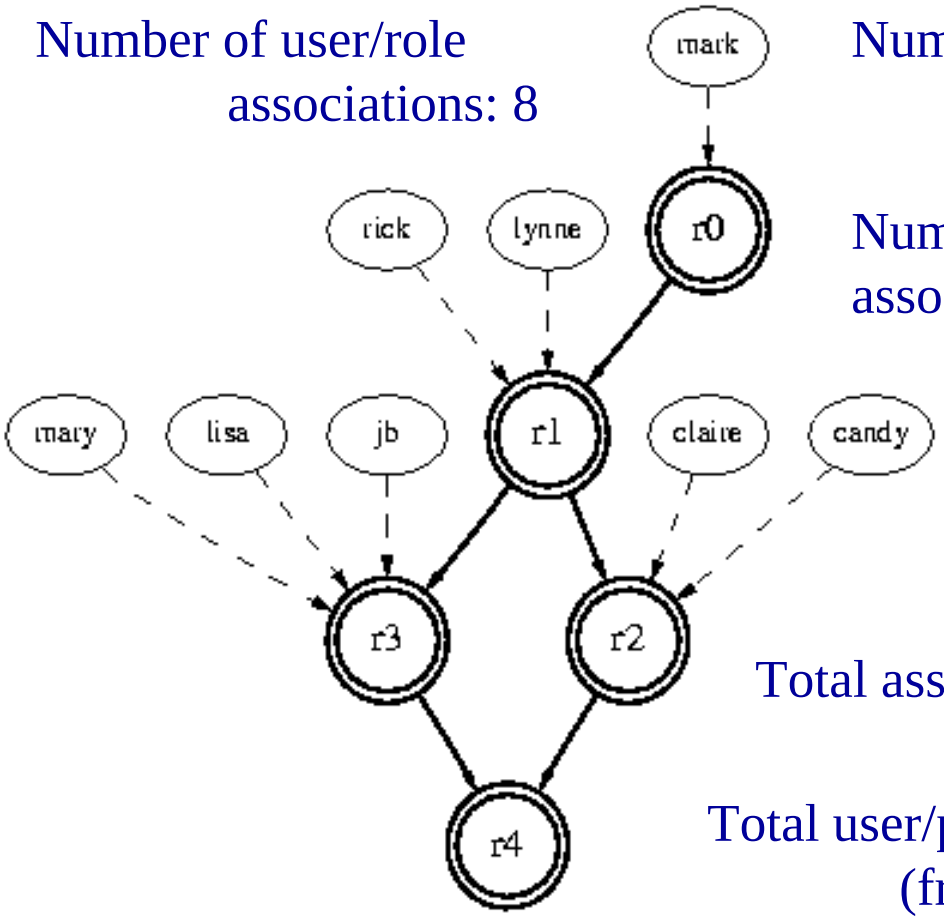


Number of role/permission associations: 8

Number of associations for role hierarchy: 5

Role Engineering Tool: user/role output

Number of user/role associations: 8



Number of associations for role hierarchy: 5

Number of role/permission associations: 8 (previous slide)

Total associations with RBAC: 21

vs.

Total user/permission associations: 28 (from earlier slide)